ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

COST (*In Thousands*)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	10616	18800	11276	10604	10453	11458	11644	Continuing	Continuing
DF21	North Atlantic Treaty Organizaion (NATO) Small Arms Evaluation	0	489	490	488	487	488	484	Continuing	Continuing
DF24	Conventional Ammunition Demilitarization	6965	12861	4513	4614	4732	4858	4992	Continuing	Continuing
D293	Field Artillery Ammunition (NATO) Engineering Development	83	0	0	0	0	0	0	0	1672
D297	Munitions Survivability & Logistics	2379	3889	4220	4234	3956	4818	4854	Continuing	Continuing
M296	Pyrotechnic Reliability and Safety	631	788	795	0	0	0	0	0	3521
M857	Explosive Safety Standards	558	773	761	771	782	798	818	Continuing	Continuing
M858	Army Explosives Safety Management Program	0	0	497	497	496	496	496	Continuing	Continuing

A. Mission Description and Justification: This Program Element supports continuing technology investigations. It provides a coordinated tri-service mechanism for the collection and free exchange of technical data on the performance and effectiveness of all non-nuclear munitions and weapons systems in a realistic operational environment. It provides for NATO interchangeability testing; joint munitions effectiveness manuals used by all services; development of standardization agreements (STANAGS) and associated Manuals of Proof and Inspection (MOPI); operation of the North American Regional Test Center (NARTC); evaluation of demilitarization methods for existing conventional ammunition; evaluation of useful shelf life, safety, reliability and producibility of pyrotechnic munitions; and improvement of explosives safety criteria for DOD munitions via the DOD Explosives Safety Board. Pyrotechnic Reliability and Safety (M296) supports pyrotechnic research, development and testing to identify, characterize and resolve reliability, safety, storage and manufacturing issues that impact production availability and field use of pyrotechnics. It will result in the development and demonstration of new, safe, reliable and environmentally acceptable munitions. Munitions Survivability and Logistics (D297) will make Army units more survivable by testing and demonstrating munitions logistics system solutions that prevent or minimize catastrophic explosive events and accelerate ammunition resupply. The Army Explosives Safety Management Program (M858) is a new start for FY 2001. The U.S. Army Technical Center for Explosives Safety will use the funds in this project to evaluate current explosives safety standards, using risk management philosophy to develop new, scientific and risk-based standards to meet U. S. Army explosives requirements.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	10422	10537	10814
Appropriated Value	10497	19037	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-75		
b. SBIR / STTR	-241		
c. Omnibus or Other Above Threshold Reductions		-74	
d. Below Threshold Reprogramming	+477		
e. Rescissions	-42	-163	
Adjustments to Budget Years Since FY 2000/2001 PB			+462
Current Budget Submit (FY 2001 PB)	10616	18800	11276

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

PROJECT: DF21

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DF21 North Atlantic Treaty Organizaion (NATO) Small Arms Evaluation	0	489	490	488	487	488	484	Continuing	Continuing

Mission Description and Justification: This program assures complete interchangeability of small caliber and automated cannon-caliber ammunition and weapons among all NATO countries with all of the associated logistic, strategic and tactical advantages. Project involves development, maintenance and testing compliance of NATO STANAGS and staffing of the NARTC.

FY 1999 Accomplishments: Project not funded in FY 1999

FY 2000 Planned Program:

- 90 Continue to staff, equip, and maintain the NARTC for 9mm, 5.56mm, and 7.62mm. Add the 12.7mm to current program
- 105 Continue to maintain standardization of previously qualified calibers, including the 25mm
- 145 Initiate facilitation of NARTC for 40mm standardization testing
- 50 Complete development of 40mm STANAG and MOPI
- 31 Participate in D/14 working group, 25/40mm POE and 5.7mm Group of Experts
- 55 Initiate activities associated with standardization of Advanced Soldier Systems
- 13 Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs

Total 489

FY 2001 Planned Program:

- 90 Continue to staff, equip and maintain the NARTC for 9mm, 5.56mm, 7.62mm and 12.7mm
- 105 Continue to maintain standardization of previously qualified calibers, including the 25mm
- 130 Continue facilitation of NARTC for 40mm standardization testing
- 65 Complete 12.7mm qualification testing
- 35 Participate in D/14 working group, 25/40mm Panel of Experts and 5.7mm Group of Experts
- 65 Continue activities associated with standardization of Advanced Soldier Systems

Total 490

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

PROJECT: DF24

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DF24 Conventional Ammunition Demilitarization	6965	12861	4513	4614	4732	4858	4992	Continuing	Continuing

Mission Description and Justification: This project supports a continuing technology evaluation of demilitarization methods for existing conventional ammunition and conventional ammunition recovered from formerly used defense sites (FUDS). It will complete the development and demonstration of new, safe, and environmentally acceptable alternatives to open burning/open detonation (OB/OD) for recovery/recycle/reclamation equipment and processes to reduce the extremely large stockpile of munitions in the resource recovery disposition account and recovered munitions from FUDS.

FY 1999 Accomplishments:

•	2000	Continued to develop cryofracture development for demilitarization of anti-personnel landmines (APL) and other munitions
•	2100	Continued demonstration program for blast chamber technology
•	1700	Completed prototype Supercritical Water Oxidation (SCWO) system installation and start-up for the demilitarization of colored smokes and dyes
•	355	Completed development of explosive rework process for cast loaded munitions
•	610	Continued testing of pilot scale plasma arc technology
•	200	Support of the Joint Ammunition Management Support System (JAMSS)
Total	6965	

FY 2000 Planned Program:

•	1650	Complete testing, evaluation, and prove-out of pilot scale plasma arc technology
•	3900	Complete cryofracture development for demilitarization of APL and other munitions
•	1064	Complete testing and evaluation of SCWO system
•	150	Complete documentation and technical data package (TDP) preparation for explosives rework system
•	125	Initiate development of recycle/reuse technology for magnesium/aluminum
	5500	Continue demonstrations of stationary and transportable contained detonation technology
	125	Initiate development of smoke pot oil recovery technology
	347	Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs
Total	12861	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **6 - Management and Support**	PE NUMBER AND TITLE **0605805A Munitions Standardization Effectiveness and Safety** PROJECT **DF24**

FY 2001 Planned Program:

•	2060	Continue testing, evaluation, and prove-out of pilot scale plasma arc technology
•	500	Continue cryofracture development for demilitarization of APL and other munitions
•	550	Initiate development of recovery/reuse technology for nitramine explosives
•	683	Continue development of recycle/reuse technology for magnesium/aluminum
•	720	Continue development of smoke pot oil recovery technology
Total	4513	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

PROJECT: D297

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D297 Munitions Survivability & Logistics	2379	3889	4220	4234	3956	4818	4854	Continuing	Continuing

Mission Description and Justification: This project makes Army units more survivable by investigating, testing and demonstrating munitions logistics system solutions that prevent or minimize catastrophic explosive events and accelerate ammunition resupply. Key thrusts are munitions storage area survivability, insensitive munitions technology integration and compliance, weapon system rearm, explosive incompatibilities in strategic configured loads and advanced packaging and distribution system enhancements. Within each thrust, a broad array of solutions will be identified, tested, and evaluated against developed system measures of effectiveness. Optimum, cost effective solutions that enable the rapid projection of lethal and survivable forces will be demonstrated. The early stages of force deployment are especially critical. Theater ammunition storage areas are vulnerable and present the enemy with lucrative targets. These areas and distribution nodes contain the only available munitions stocks in theater. Loss of these munitions could cripple the force, jeopardize the mission, and result in high loss of life. This project mitigates vulnerabilities and ensures a survivable fighting force.

FY 1999 Accomplishments:

- 540 Developed concept and design architecture of prototype munitions storage area planning software tool that allow **s** soldiers to quickly design survivable and efficient ammunition storage sites
- 278 Completed study of the explosive safety hazards in storage and transport caused by incompatible munitions in proposed Strategic Configured Loads (SCL) and develop concepts for mitigating these hazards
- 134 Developed manipulator control architecture for a smart munitions handling crane that will leverage the reduced ammunition force structure and facilitate the rapid configuration or reconfiguration of munitions loads in-theater
- 226 Populated database of Army munitions compliance status with DoD 5000.2-R requirement that all munitions be designed to withstand unplanned stimuli
- 241 Completed concept, fabrication, and testing of a barrier system for tank ammunition packaging that makes the tank munition less sensitive to unplanned stimuli. Developed concept for incorporating a propellant fire extinguishing capability into tank ammunition packaging designs
- 171 Evaluated less heat sensitive propellants and designs for a projectile venting system that relieves gas pressure for M915 and XM916 Dual Purpose Improved Conventional Munition (DPICM) cartridges to reduce reaction to unplanned stimuli
- 210 Developed and evaluated low melting point ballistic protection material inserts for missile packaging (PAC-3, THAAD, MLRS, etc.) that will contain the cycloid projectiles within the canister or lower their exit velocity. The inserts will also protect the munition from bullet and fragment impacts
- 50 Completed testing of THAAD missile propellant to determine tensile strength and burning characteristics and prepared report to baseline future insensitive munitions (IM) propellant development

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **6 - Management and Support**	PE NUMBER AND TITLE **0605805A Munitions Standardization Effectiveness and Safety** PROJECT **D297**

FY 1999 Accomplishments: (continued)

- 95 Conducted reviews of munitions in development and production to determine if they meet the DoD 5000.2-R requirement to withstand unplanned stimuli and recommended technical approaches to meet this requirement
- 106 Conducted market survey of corrosion prevention materials suitable for use in munitions packaging and purchased candidates for evaluation
- 208 Selected materials and candidate munition item and completed design of a lightweight packaging prototype for large munitions (VOLCANO dispenser system, Javelin, Multipurpose Individual Munition-Short Range Anti-tank Weapon (MPIM-SRAW), Precision Guided Mortar Munition, etc.) that will reduce the manpower and handling required to move heavy/bulky munitions
- 41 Determined Special Operations Forces ammunition requirements and developed man-portable mixed ammunition packaging utilizing standard containers
- 79 Conducted a study of the planned production levels and consumption rates of all Army munitions used for training and identified likely candidates for reduced packaging configurations (to reduce operations and support costs and provide easier disposal of waste packaging)

Total 2379

FY 2000 Planned Program:

- 1187 Complete software design architecture and development of safety and survivability planning information modules for the prototype munitions storage area planning software tool. Develop guidelines for munitions barricade sizing relative to donor stack explosive mass
- 151 Conduct compatibility assessment tests and develop conceptual designs of packaging and mitigation solutions for incompatible munitions SCLs
- 541 Design a manipulator/end effector and develop 3-D and motion simulation models for a smart munitions handling crane
- 250 Identify specific insensitive munitions (IM) technologies that can be applied to individual Army munitions, update database, and identify IM improvement priorities
- 135 Complete the design of ammunition packaging that incorporates a propellant fire extinguishing capability which helps tank ammunition meet the requirement to withstand unplanned stimuli
- 250 Test less heat sensitive propellants and continue design evaluation for alternative projectile venting systems that relieve gas pressure for M915 and XM916 DPICM projectiles
- 200 Complete fragment/bullet mitigation testing and evaluation of low melting point ballistic protection material inserts for missile packaging and prepare final report
- 131 Continue reviews of munitions in development and production to determine if they meet DoD 5000.2-R requirement to withstand unplanned stimuli and recommend technical approaches to meet the requirement
- 167 Evaluate alternative ignition concepts and minimum venting requirements for an active venting system for artillery munitions to help minimize the reaction to high levels of heat and fire
- 191 Select low temperature gas generating material that when added to artillery and mortar munitions, will react to heat and fire and generate sufficient pressure to safely split a projectile prior to a violent reaction from high explosive material, thereby helping the munition meet the requirement to withstand unplanned stimuli

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **6 - Management and Support**	PE NUMBER AND TITLE **0605805A Munitions Standardization Effectiveness and Safety**
	PROJECT **D297**

FY 2000 Planned Program: (continued)

•	100	Complete liner redesign, conduct baseline tests and loading evaluation of less sensitive explosives that will replace Comp A-5 in the MLRS M85 grenade
•	180	Conduct engineering testing of candidate corrosion prevention materials to determine suitability for use in munitions packaging
•	320	Complete functional element analysis of design and fabricate lightweight packaging prototype for large munitions. Conduct baseline **tests** of prototype
•	86	Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs
Total	3889	

FY 2001 Planned Program:

•	700	Complete development and integration of safety and survivability planning information modules, develop linkage to the Standard Army Ammunition System (SAAS), and conduct engineering testing of a prototype munitions storage area planning software tool
•	755	Conduct initial user evaluation and design multi-layer control software for the smart munitions handling crane
•	150	Complete development of and maintain Army insensitive munitions (IM) compliance status database
•	227	Modify packaging design and conduct engineering testing of ammunition packaging that incorporates a propellant fire extinguishing capability to help tank ammunition meet the requirement to withstand unplanned stimuli
•	200	Analyze test results and modify, if necessary, less heat sensitive propellants and projectile venting systems that relieve gas pressure for M915 and XM916 DPICM projectiles. Complete test plan for modified/improved prototypes
•	140	Conduct reviews of munitions in development and production to determine if they meet the DoD 5000.2-R requirement to withstand unplanned stimuli and recommend technical approaches to meeting the requirement
•	250	Complete design and development of a prototype ignition device for an active venting system for artillery munitions
•	220	Conduct sub scale testing and refine low temperature gas generating material/explosive formulation prior to full scale testing and fabricate prototype projectile with lifting plug for the Low Temperature Gas Generator program
•	1090	Modify and conduct IM testing of less sensitive high explosives for the MLRS M85 grenade. Evaluate propellants and impact and heat resistant rocket motor case materials for missiles (MLRS, ATACMS-BAT, PAC-3, THAAD, ETC) that will reduce the reaction to unplanned stimuli. Develop test plans
•	200	Analyze test results, modify design, and conduct instrumented testing of lightweight packaging prototype for large munitions
•	110	Develop concepts and design prototype lightweight composite containers for medium and small caliber ammunition that will increase handling efficiency and reduce environmental impact compared to currently fielded containers
•	178	Conduct a market survey and purchase candidate coatings and materials that, when applied or inserted into packaging, will reduce the accelerated aging of ammunition energetics, electronics and propellants due to solar heating
Total	4220	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

PROJECT: D297

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
M296 Pyrotechnic Reliability and Safety	631	788	795	0	0	0	0	0	3521

Mission Description and Justification: This project will support pyrotechnic research, development and testing to identify, characterize and resolve reliability, safety, storage and manufacturing issues that impact production availability and field use of pyrotechnics, including training realism. Project will result in the development and demonstration of new, safe, reliable and environmentally acceptable munitions.

FY 1999 Accomplishments:

- 120 Developed and investigated merit of substitutes for critical, sole-source and toxic materials. Performed preliminary testing to screen candidate materials.
- 175 Designed safer pyrotechnic munitions/systems for reduced fragmentation effects and tamper resistant configurations.
- 201 Developed alternative to magnesium. Conducted parametric formulations, performance characterization/evaluations and optimization of selected candidates in white, green, and red illuminants.
- 135 Completed technology pyrotechnic shelf life study. Conducted environmental tests under various temperature/humidity conditions. Perform function test and evaluation on conditioned items.

Total 631

FY 2000 Planned Program:

- 236 Complete development of alternative to magnesium. Develop formulations and conduct performance characterization/evaluations. Optimize weapons effects simulator design.
- 301 Develop safer pyrotechnic munition/systems specific to light amplification by stimulated emission of radiation techniques
- 230 Investigate merit of substitutes for critical, sole-source, and toxic materials. Perform formulation development, parametric studies, and performance characterization
- 21 Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs

Total 788

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **6 - Management and Support**	PE NUMBER AND TITLE **0605805A Munitions Standardization Effectiveness and Safety**
	PROJECT **D297**

FY 2001 Planned Program:

•	232	Eliminate incompatible and hygroscopic pyrotechnic ingredients in pyrotechnic munitions/system. Initiate improvement of the pyrotechnic reliability and manufacturing process controls
•	330	Develop and test safer pyrotechnic munition/systems specific to light amplification by stimulated emission of radiation techniques
•	233	Investigate merit of substitutes for critical, sole-source, and toxic materials. Perform formulation development, parametric studies, and performance characterization
Total	795	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

PROJECT: M296

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
M857 Explosive Safety Standards	558	773	761	771	782	798	818	Continuing	Continuing

Mission Description and Justification: Supports explosive safety effects research and testing to quantify hazards and to develop techniques to mitigate those hazards in all DOD manufacturing, testing, transportation, maintenance, storage and disposal of ammunition and explosives operations. Results are essential to the development and improvement of quantity-distance standards, hazard classification procedures, cost effective explosion-resistant facility design procedures, and personnel hazard/protection criteria.

FY 1999 Accomplishments:

- 60 Collected and analyzed airblast/fragment/thermal data for revising DOD, NATO and United Nations hazard classification interpretations for Hazard Divisions 1.1, 1.2 and 1.6
- 140 Developed improved explosives and munitions tests and characterization data
- 338 Developed improved DOD and NATO explosives safety guidelines for munitions storage and explosives operation facilities
- 20 Conducted other hazards analyses and expanded automated explosives safety data bases

Total 558

FY 2000 Planned Program:

- 150 Continue to collect and analyze airblast/fragment/thermal data for revising DOD, NATO and United Nations hazard classification interpretations for Hazard Divisions 1.1, 1.2, 1.3, 1.4, 1.4S, 1.5 and 1.6
- 200 Continue development of improved tri-service design procedures and improved computer codes for explosion-resistant structures
- 30 Continue development of improved explosives and munitions tests and characterization data
- 312 Continue to develop improved DOD and NATO explosives safety guidelines for munitions storage, explosives operating and field operation facilities
- 60 Continue to conduct other hazards analyses and expand/automate explosives safety data bases
- 21 Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs

Total 773

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **6 - Management and Support**	PE NUMBER AND TITLE **0605805A Munitions Standardization Effectiveness and Safety** PROJECT **M296**

FY 2001 Planned Program:

•	150	Continue to collect and analyze airblast/fragment/thermal data for revising DOD, NATO and United Nations hazard classification interpretations for Hazard Divisions 1.1, 1.2, 1.3, 1.4, 1.4S, 1.5 and 1.6
•	150	Continue development of improved tri-service design procedures and improved computer codes for explosion-resistant structures
•	100	Continue development of improved explosives and munitions tests and characterization data
•	211	Continue to develop improved DOD and NATO explosives safety guidelines for munitions storage, explosives operating and field operation facilities
•	150	Continue to conduct other hazards analyses and expand/automate explosives safety data bases
Total	761	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 6 - Management and Support

PE NUMBER AND TITLE: 0605805A Munitions Standardization Effectiveness and Safety

PROJECT: M857

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
M858 Army Explosives Safety Management Program	0	0	497	497	496	496	496	Continuing	Continuing

Mission Description and Justification: This project supports the U.S. Army's explosives safety program. Many existing Army explosives safety standards in manufacturing, testing, transportation, maintenance, storage, and disposal are based on limited accident investigation data. The U.S. Army Technical Center for Explosives Safety will use the funds in this project to support the Army's explosives safety program by conducting research and testing to evaluate current explosives safety standards, using risk management philosophy to develop new, scientific and risk-based standards to meet U. S. Army explosives requirements in AR 385-64 and DA PAM 385-64.

FY 1999 Accomplishments: Project not funded in FY 1999

FY 2000 Planned Program: Project not funded in FY 2000

FY 2001 Planned Program:

- 448 Conduct testing on strategic configured loads (SCL) to assess safety hazards in deployment operations
- 49 Initiate testing of earth-covered magazines with electrically isolated floors to assess lightning hazards to stored ammunition

Total 497